



# Bay Linear

Linear Excellence

## POWER MOSFET

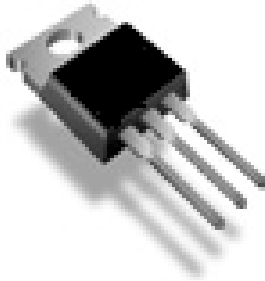
## IRF540

### Advance Information

### Description

The Bay Linear MOSFET's provide the designers with the best combination of fast switching, ruggedized device design, low On-resistance and low cost-effectiveness.

The TO-220 is offered in a 3-pin is universally preferred for all commercial-industrial applications at power dissipation level to approximately to 50 Watts. Also, available in a D<sup>2</sup> surface mount power package with a power dissipation up to 2 Watts.



### Features

- **Dynamic dv/dt Rating**
- **Repetitive Avalanche Rated**
- **Fast Switching**
- **Ease of Paralleling**
- **Simple Drive Requirements**

$$V_{DSS} = 100V$$

$$R_{DS(ON)} = 0.077 \Omega$$

$$I_D = 28A$$

### Ordering Information

| Device  | Package                   | Temp.      |
|---------|---------------------------|------------|
| IRL540T | TO-220                    | 0 to 150°C |
| IRL540S | TO-263 ( D <sup>2</sup> ) | 0 to 150°C |

### Absolute Maximum Rating

|                           | Parameter                                                | Max                   | Unit |
|---------------------------|----------------------------------------------------------|-----------------------|------|
| $I_D @ T_C = 25^\circ C$  | Continuous Drain Current, $V_{GS} @ 10V$                 | 28                    | A    |
| $I_D @ T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$                 | 20                    |      |
| $I_{DM}$                  | Pulsed Drain Current                                     | 110                   |      |
| $P_D @ T_C = 25^\circ C$  | Power Dissipation                                        | 150                   | W    |
| $P_D @ T_A = 25^\circ C$  | Power Dissipation ( PCB Mount, D <sup>2</sup> ) (1)      | 3.7                   |      |
|                           | Linear Derating Factor                                   | 1.0                   | W/°C |
|                           | Linear Derating Factor ( PCB Mount, D <sup>2</sup> ) (1) | 0.025                 |      |
| $V_{GS}$                  | Gate-to- Source Voltage ( TO-220 )                       | ±20                   | V    |
| $V_{GS}$                  | Gate-to- Source Voltage ( D <sup>2</sup> )               | ±10                   |      |
| $E_{AS}$                  | Single Pulse Avalanche Energy ( TO-220 ) (2a)            | 230                   | mJ   |
| $E_{AS}$                  | Single Pulse Avalanche Energy ( D <sup>2</sup> ) (2b)    | 440                   |      |
| $I_{AR}$                  | Avalanche Current                                        | 28                    | A    |
| $E_{AR}$                  | Repetitive Avalanche Energy                              | 15                    | mJ   |
| dv/dt                     | Peak Diode Recovery dv/dt                                | 5.5                   | V/ns |
| $T_J, T_{STG}$            | Junction & Storage Temperature Range                     | -55 to +175           | °C   |
|                           | Soldering Temperature, for 10 seconds                    | 300 (1.6mm from case) |      |

### Thermal Resistance

|                 | Parameter                                         | Min | Typ  | Max | Units |
|-----------------|---------------------------------------------------|-----|------|-----|-------|
| $R_{\theta JC}$ | Junction-to Case                                  | -   | -    | 1.0 | °C/W  |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface ( TO-220 )    | -   | 0.50 | -   |       |
| $R_{\theta JA}$ | Junction-to Ambient ( PCB Mount, D <sup>2</sup> ) | -   | -    | 40  |       |
| $R_{\theta JA}$ | Junction-to Ambient                               | -   | -    | 62  |       |

**Electrical Characteristics (  $T_C = 25^\circ\text{C}$  unless otherwise specified)**

| Symbol                     | Parameter                                 | Conditions                                                                              | Min | Typ  | Max   | Units               |
|----------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------|-----|------|-------|---------------------|
| $V_{(BR)DSS}$              | Drain-to-source Breakdown Voltage         | $V_{GS} = 0V, I_D = 250\mu A$                                                           | 100 |      |       | V                   |
| $V_{(BR)DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | Reference to $25^\circ\text{C}$ ,<br>$I_D = 1mA$                                        | -   | 0.13 | -     | V/ $^\circ\text{C}$ |
| $I_{D(ON)}$                | On-State Drain Current (note 2)           | $V_{GS} > I_{D(ON)} \times R_{DS(ON)} \text{Max}$                                       |     |      | 28    | A                   |
| $R_{DS(ON)}$               | Static Drain-to-Source On-Resistance      | TO-220: $V_{GS} = 10V, I_D = 17A$<br>D <sup>2</sup> : $V_{GS} = 5V, I_D = 17A$ (note 4) |     |      | 0.077 | $\Omega$            |
| $V_{GS(TH)}$               | Gate Threshold Voltage                    | $V_{DS} = V_{GS}, I_D = 250\mu A$                                                       | 2.0 | -    | -     | V                   |
| $g_{fs}$                   | Forward Transconductance                  | $V_{DS} = 50V, I_D = 17A$                                                               | 8.7 | -    | -     | S                   |
| $I_{DSS}$                  | Drain-to –Source Leakage Current          | $V_{DS}=100V, V_{GS}=0V$                                                                | -   | -    | 25    | $\mu A$             |
|                            |                                           | $V_{DS}=80V, V_{GS}=0V, T_J=150^\circ\text{C}$                                          |     |      | 250   |                     |
| $I_{GSS}$                  | Gate-to-Source Forward Leakage            | $V_{GS} = 20V$                                                                          | -   | -    | 100   | nA                  |
|                            | Gate-to-Source Reverse Leakage            | $V_{GS} = -20V$                                                                         |     |      | -100  |                     |
| $Q_G$                      | Total Gate Charge                         | $I_D=17V$                                                                               | -   | -    | 72    | nC                  |
| $Q_{gs}$                   | Gate- to -Source Charge                   | $V_{DS}=80V$                                                                            | -   | -    | 11    |                     |
| $t_{d(on)}$                | Turn-On Delay Time                        | $V_{DD}=50V$                                                                            | -   | 11   | -     | ns                  |
| $t_f$                      | Fall Time                                 | $R_D=2.9$                                                                               | -   | 43   | -     |                     |
| $t_{d(off)}$               | Turn -Off Delay Time                      | $R_G=9.1\Omega$                                                                         | -   | 53   | -     |                     |
| $t_r$                      | Rise Time                                 | $I_D=17A$                                                                               | -   | 44   | -     |                     |
| $L_D$                      | Internal Drain Inductance                 | Between lead 6mm(0.25in.) from package and center or die contact                        | -   | 4.5  | -     | nH                  |
| $L_S$                      | Internal Source Inductance                |                                                                                         | -   | 7.5  | -     |                     |
| $C_{iss}$                  | Input Capacitance                         | $V_{GS}=0V$                                                                             | -   | 1700 | -     | pF                  |
| $C_{oss}$                  | Output Capacitance                        | $V_{DS}=25V$                                                                            | -   | 560  | -     |                     |
| $C_{rss}$                  | Reverse Transfer Capacitance              | $F = 1.0\text{MHz}$                                                                     | -   | 120  | -     |                     |

**Source-Drain Rating Characteristics**

| Symbol   | Parameter                              | Conditions                                                                  | Min | Typ | Max | Units   |
|----------|----------------------------------------|-----------------------------------------------------------------------------|-----|-----|-----|---------|
| $I_S$    | Continuous Source Current (Body Diode) | MOSFET symbol showing the integral reverse p-n junction diode.              | -   | -   | 28  | A       |
| $I_{SM}$ | Pulsed Source Current (Body Diode)     |                                                                             | -   | -   | 110 |         |
| $V_{SD}$ | Diode Forward Voltage                  | $T_J=25^\circ\text{C}, I_S=28A, V_{GS}=DV$                                  | -   | -   | 2.5 | V       |
| $t_{rr}$ | Reverse Recovery Time                  | $T_J=25^\circ\text{C}, I_F=17A$                                             | -   | 180 | 360 | ns      |
| $Q_{rr}$ | Reverse Recovery Charge                | $di/dt=100A/\mu s$                                                          | -   | 1.3 | 2.8 | $\mu C$ |
| $t_{on}$ | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $(L_S+L_D)$ ) |     |     |     |         |

Notes: 1. Repetitive Rating; pulse width limited by max. junction temperature.

2a.  $V_{DD} = 25V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 440\mu H$   $R_G = 25\Omega$ ,  $I_{AS} = 28A$

2b.  $V_{DD} = 25V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 841\mu H$   $R_G = 25\Omega$ ,  $I_{AS} = 28A$

3.  $I_{SD} \leq 28A$ ,  $di/dt \leq 170A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$

4. Pulse with  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$

**Advance Information-** These data sheets contain descriptions of products that are in development. The specifications are based on the engineering calculations, computer simulations and/ or initial prototype evaluation.

**Preliminary Information-** These data sheets contain minimum and maximum specifications that are based on the initial device characterizations. These limits are subject to change upon the completion of the full characterization over the specified temperature and supply voltage ranges.

The application circuit examples are only to explain the representative applications of the devices and are not intended to guarantee any circuit design or permit any industrial property right to other rights to execute. Bay Linear takes no responsibility for any problems related to any industrial property right resulting from the use of the contents shown in the data book. Typical parameters can and do vary in different applications. Customer's technical experts must validate all operating parameters including " Typical" for each customer application.

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